

## **AIR DEFLECTOR FOR A VEHICLE ROOF**

### **REFERENCE TO RELATED APPLICATIONS**

- [1] The present invention claims the benefit of German Patent Application No. 103 08 583.1, filed February 27, 2003.

### **TECHNICAL FIELD**

- [2] The present invention relates to an air deflector for a vehicle roof, such as air deflectors used in connection with a sliding sunroof or a folding roof system.

### **BACKGROUND OF THE INVENTION**

- [3] Vehicle roofs, and specifically sliding sunroofs or folding roof systems, may employ air deflectors to improve air flow conditions over the vehicle when the cover of the roof system is in an open position. The air deflector is usually arranged on a front edge, with respect to the travel direction of the vehicle, of the roof opening that is closed by the cover. The air deflector can also be conveyed from a lowered position, in which it is located beneath the outer surface of the vehicle roof, to a raised position when the cover is opened.
- [4] The air deflector can employ a flexible web or fabric as a deflector element and arrange the deflector element between two holding elements. A first holding element is fixedly attached to the vehicle roof and the second holding element can move between a lowered and a raised position. If the second holding element is in its lowered position, then the deflector element can be folded to save space due to its flexibility. The result is a compact assembly, especially with respect to the overall height of the deflector element.
- [5] The flexible deflector element has one disadvantage, however, it does not fold up in a self-controlling fashion. Thus, a comparatively large amount of space must be made available to allow the deflector element to move freely within its range when the second holding element is conveyed to the lowered position without the deflector element coming into conflict with other components of the sliding sunroof system. Alternatively, if such a large amount of space is not available, the deflector element must be secured in another way so that the deflector element does not collide with other components when the second holding element is placed in the lowered position.

- [6] There is a desire for an air deflector structure that can control movement of the deflector element without experiencing the disadvantages encountered in currently-known structures.

### **SUMMARY OF THE INVENTION**

- [7] The present invention is directed to an air deflector for a vehicle roof comprising a first holding element, which is designed to be attached to the vehicle roof; a second holding element, which can be moved between a lowered and a raised position; a flexible deflector element, which is secured to both holding elements; and at least one flexible positioning element, which pushes the deflector element in a pre-established direction when the second holding element is moved from the raised to the lowered position. The positioning element is advantageously an elastically deformable lip that is configured as an integral component of a piping or weather strip provided on the deflector element. Due to the inherent elasticity of the positioning element, it pushes the deflector element in a predetermined direction when the deflector element begins to relax, allowing the deflector element to be freely folded up without interfering with other vehicle components.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

- [8] The present invention is described below on the basis of an example embodiment, which is depicted in the attached drawings:
- [9] Figure 1 is a top view depicting a vehicle roof having a sliding sunroof system, the cover of the sliding sunroof system being shown in the opened position;
- [10] Figure 2 is a perspective view taken in the direction of Arrow II from Figure 1 and showing an air deflector that is used in the sliding sunroof system according to one embodiment of the invention;
- [11] Figure 3 is a schematic view taken along plane III-III from Figure 1;
- [12] Figure 4 is a view corresponding to the view in Figure 3 showing the cover in the closed position.

**DETAILED DESCRIPTION OF THE EMBODIMENTS**

- [13] Figure 1 shows a vehicle roof 5 having a sliding sunroof system with a roof opening 6 and a cover 7. The cover 7 can be moved from a closed position, in which it closes roof opening 6, to an opened position. Figure 1 shows the cover 7 in an opened position in which most of the roof opening 6 is exposed.
- [14] An air deflector 10 is attached on the front edge of roof opening 6 with respect to the vehicle. The air deflector 10 can be raised toward the outside of the vehicle when the cover 7 is in its opened position.
- [15] As shown in Figure 2, the air deflector 10 comprises a first holding element 12 that is fixedly attached to the vehicle or to a sliding sunroof frame 30 and a second holding element 14 that is movable relative to the first holding element. More particularly, the second holding element 14 is movable between a first, lowered position, in which it is located beneath the outer skin of the vehicle roof 5 so that the cover 7 can be closed, and a second, raised position, as shown in Figure 2, in which the second holding element 14 extends toward the outside of the vehicle beyond the outer skin of the vehicle roof 5.
- [16] The precise manner in which the second holding element articulates on the vehicle roof as well as the mechanism for moving the second holding element between the raised and lowered positions is not relevant for understanding the present invention, so no further discussion thereof will be entered into here. The only relevant feature is that the air deflector 10 includes a mechanism that conveys the second holding element 14 from the raised to the lowered position when the roof 7 is closed.
- [17] A flexible deflector element 16 is arranged between the first holding element 12 and the second holding element 14. The flexible deflector element 16 can be made of any flexible sheet-like material, such as a web or fabric part. A first edge of the deflector element 16 has a first piping or weather strip 18 and is assigned to the first holding element 12 and a second edge of the deflector element 16 has a second piping or weather strip 20 and is assigned to the second holding element (Figure 3). In one embodiment, both pipings 18, 20 are made of plastic and are secured to the deflector element 16. The first piping 18 is received in the first holding element 12 and the second piping 20 is received in the second holding element 14. If the second holding element 14 is in its raised position, the deflector element 16 is stretched taut between the two holding elements 12, 14 as shown in Figure 3.

- [18] A positioning element 22 is integrally formed with the first piping 18. In the illustrated embodiment, the positioning element 22 is configured as a flexible, elastically deformable and resilient lip. The positioning element 22 has two shanks 24, 26 that are arranged roughly at a right angle to each other when the air deflector 10 is in an initial state, i.e., when no external forces are acting on the air deflector 10 (Figure 4). The first shank 24 extends in an upward direction, in the direction that the deflector element 16 would extend if it were stretched tight, and the second shank 26 extends roughly horizontally towards the front of the vehicle.
- [19] When the deflector element 16 is stretched tight when the air deflector 10 is in the opened position, the second shank 26 of the positioning element 22 is elastically bent upward by roughly 90° so that it extends in the same direction as the first shank 24 and the stretched deflector element 16 (Figure 3).
- [20] As soon as second holding element 14 is moved in a downward direction to its lowered position, the tension in the deflector element 16 relaxes. As a result, the second shank 26 of the positioning element 22 can elastically return to its initial position (i.e., moving 90° in a counterclockwise motion in the orientation shown in Figures 3 and 4). When the positioning element 22 relaxes, it pulls the deflector element 16 and guides the deflector element 16 as it folds. In the orientation in Figures 3 and 4, the lower portion of the deflector element 16 is directed toward the left as it folds up in a space to the left of the first holding element 12. The positioning element 22 directs the deflector element 16 away from a seal 28, which is arranged near the air deflector 10, and ensures that the deflector element 16 is not folded up over the seal 28.
- [21] It should be understood that various alternatives to the embodiments of the invention described herein may be employed in practicing the invention. It is intended that the following claims define the scope of the invention and that the method and apparatus within the scope of these claims and their equivalents be covered thereby.